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MODELLING ECONOMIC GROWTH IN SUB-SAHARAN AFRICA: A PANEL DATA APPROACH

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ABSTRACT

The debate on the effectiveness of macro-economic variables as a tool for promoting growth and development remains inconclusive given conflicting results of recent studies. Thus, the controversy is yet to be settled. Against this background, this study sought to fit a model to best predict economic growth in sub-Saharan Africa considering Government revenue, Trade Openness, Urbanization and Fiscal Freedom as the predictor variables and hence further explains the combined effect of the variables on economic growth. The study made use of secondary data of sub-Saharan African Countries in panel least squares. The hypotheses were linearly tested while adopting the panel data estimation under fixed-effect assumptions. Findings reveal that all the variables except fiscal freedom has a positive and significant effect on the economic growth of sub-Saharan Africa when the countries were pooled together. Only government revenue has a negative and insignificant effect on the economic growth of the countries in the fixed-effect model which considers the heterogeneity and individuality of the countries. The study therefore recommends that Governments of sub-Saharan Africa countries should engage in critical check on the revenue generated. Improving and strengthening the fiscal freedom so as to attract inflows of investors in order to boost the economic growth and improving the standard of living of the citizens is also recommended.

Keywords: macro-economic, government revenue, trade openness, urbanization, fiscal freedom, and Gross domestic product, panel estimation, heterogeneity, fixed effect

1. INTRODUCTION

Studies has provided insights into why there is difference in the growth rate of the economy of states over time and that the level at which an economy will grow, is also determined by the choices a government makes in her tax and expenditures. Studies on the growth of an economy and its drivers have received attention among scholars but with differing evidences. Abata, et al., (2012), observed that the expansion of a country's potential Gross Domestic Product (GDP) or output represents its Economic growth.

Ulku(2004) emphasized that variation in the 48 countries of the region are extremely high, they vary in size and the economic history, with many small countries and giants such as Nigeria. In sub-Saharan Africa, the social and economic situation, remains delicate and susceptible to domestic and external shocks The ventures in sub-Saharan Africa has remained subdued, and efforts to diversify economic structures and boost growth has been limited (Nkurunziza and Bates, 2004). More so, there have been severe setbacks in development efforts of countries that have recently emerged from civil wars whereas fresh armed conflicts have erupted in other parts of the continent. Adverse conditions, such as poor weather conditions and decline in trade including conflicts, have led to loss in the drive of economy of this region over the last two decades (Ulku, 2004; Nkurunziza and Bates, 2004).

Therefore, the countries in this region are faced with key challenges such as raising economic growth, curbing poverty, reducing conflicts, also trying to integrate itself into the growing world economy. Although, growth in the economy is still not high enough (Nkurunziza and Bates, 2004) to cause an actual change in the prevailing poverty and enable these countries to compete with other developing countries.

2. LITERATURE REVIEW

Ullah and Rauf (2013) noted that whenever there is increase in real GDP of a country it will boosts up the overall output and we called it economic growth. The economic growth is helpful to increase the incomes of the society, help the nation to bring the unemployment at low level and also helpful in the deliveries of public services.

Fadare (2010) noted that growth in economy has long been considered an important aspect of policy making in economy with a substantial body of research dedicated to explaining how this aspect can be achieved.

Khorravi & Karimi (2010) observed that economic growth is largely linked to labour and capital as factors of production. The development of the endogenous growth theory has encouraged specialists to question the role of other factors in explaining the economic growth phenomenon.

Economic growth in sub-Saharan Africa

According to Andersan and Tarp (2003), there is weak evidence of growth-led finance using market size as the indicator of stock market development. In summary, the picture that emerges from the different econometric studies is blurred. In cross-section studies there is a positive correlation between financial development and growth, but in the poorest countries the correlation is negative. In individual-country studies, different causal patterns between financial development and economic growth are characteristic. In some countries, finance seems to lead growth, while there is reverse causality or no clear causal link elsewhere. Moreover, conclusions are very sensitive to the type of estimator used and slight changes in nuisance parameters often change the results.

Research and development (R&D) is another important determinant of economic growth. It plays a major role in economic progress by way of increasing productivity and growth (Artelaris *et al.,* 2007) since the increased use of technology enables introduction of new and superior products and processes. This role has been stressed by various endogenous growth models with the strong relation between R&D and economic growth being empirically affirmed by many studies.

Economic policies and macroeconomic conditions have also attracted much attention as determinants of economic performance. This is because they can set the framework within which economic growth takes place (Barro and Sala-i-Martin, 1995). Economic policies can influence several aspects of an economy through investment in human capital and infrastructure, improvement of political and legal institutions. In addition, a stable macroeconomic environment may favour growth through the reduction of uncertainty, whereas

macroeconomic instability may have a negative impact on growth through its effects on productivity and investment.

Openness to trade has also been used extensively in the economic growth literature as a major determinant of growth performance (Artelaris *et al.*, 2007). Openness affects economic growth through several channels such as exploitation of comparative advantage, technology transfer and diffusion of knowledge, increasing scale economies and exposure to competition. Openness is usually measured by the ratio of exports to GDP (Dollar and Kraay, 2000). It has been found that economies that are more open to trade and capital flows have higher GDP per capita and grow faster.

Foreign Direct Investment (FDI) has recently played a crucial role of internationalizing economic activity and as a primary source of technology transfer and economic growth. The empirical literature examining the impact of FDI on growth has provided more-or-less consistent findings affirming a significant positive link between the two (Lensink and Morrissey, 2006).

3. METHODOLOGY

Nature and Data Sources

The nature of the data used for this study was a cross-sectional and time series data which is a secondary source of data collected from International Monetary Fund (IMF) and World Bank Data websites of selected sub-Saharan Africa countries spanning from 2003 to 2012.

Given the wide geographical location of African continent, studying countries of African continent though not impossible could be cumbersome. While this could be technically possible at least within the context of this work, a sample was considered ideal to be used for this study which include: Nigeria, South Africa, Burkina faso, Egypt, Uganda, Ethiopia, Ghana, Kenya, Tunisia, Angola, Morocco, Cote d'Ivoire, Mali, Benin, Madagascar, Namibia, Seychelles, Sierra Leone, Togo.

Model Specification

Many research work has been carried out on the use of pooled OLS and other economic models such as random effects and fixed effect model on the impact on many micro and macro-economic theory and policies. Research conducted by Tina Vuko and Marko Cular (2014) who used pooled cross-sectional model to establish dependencies of audit opinion, leverage, profitability, audit effort, absolute level of total accruals, company size and audit committee on Audit delay or reporting. In order to test our hypotheses on the impact of the macro-economic variables on economic growth, we estimate the following pooled cross-sectional regression:

$$EG_{it} = \alpha + \beta GR_{it} + \gamma OT_{it} + \delta UR_{it} + \theta FF_{it} + \epsilon_{it}$$

Where EG = economic growth (dependent variable), GR = government revenue, OT = degree of openness to trade, UR = urbanization, FF = fiscal freedom, i denotes the different sub-Saharan African countries in the sample and t denotes the time dimension. While ϵ_{it} is the random error for country i and year t.

However before proceeding on fitting such model, the panel diagnostics tool of Hausman, H statistic which is a unit scalar from a positive definite matrix and distributed as chi-square distribution would be used to identify whether fixed effect model or random effect model is best for this research work, while also running a background check on the model diagnostics to ensure conformance with assumptions such as normality, heteroscedasticity among others.

Techniques of Analysis

The economic pooled cross-sectional model was proposed for this research work among others to establish whether or not relationship exist between the dependent variable and the stated set of predictors variables which are measured on continuous scale, the parameters estimates are expected to be linear while it is also expected that the predictors (independent variables) be as independent/uncorrelated as much as possible, should this assumption fail, multicollinearity set in which renders the results inconsistent and inaccurate.

Panel Data Estimation

Panel data or longitudinal data sets are defined as one that combine time series and cross sections, in other words panel data sets are repeated measurements at different points in time on the same unit such as an individual, household, industry, firm or, in this case, country. Estimations based on panel data sets can therefore capture variation in cross sectional units over time. However, modelling in this setting requires more complex stochastic specifications. The main focus of the analysis when using panel data is the heteroscedasticity across cross-sectional units (Greene (2002); Wooldridge (2002))

4. EMPIRICAL RESULTS AND DISCUSSION

Table 1 presents a descriptive statistics on all the variables of interest. Economic growth (per capita GDP) of the selected Sub-Saharan African countries has a mean value of 2.9833 per capita GDP with minimum and maximum being 2.1324 and 4.1544 respectively. Government revenue stands at an average of 20.7855% of GDP with maximum of 57.7875% and crashed with a minimum of 4.9996%. Openness to trade has a mean value of 0.7624% share of GDP with maximum value at 2.1731% and minimum of 0.3073%. The Urbanization rate stands at an average of 39.6803% with maximum and minimum value being 77.9880% and 12.4830% respectively. While Fiscal freedom as a mean value of 73.4591 with maximum and minimum value being 95.0000 and 49.7000 respectively.

Table 1. Descriptive statistics for the economic variables.

Variables					
Statistics	EG	GR	OT	UR	FF
• Mean	2.9833	20.7855	0.7624	39.6803	73.4591
• Median	2.7812	17.0051	0.6569	39.4480	74.8000
• Minimum	2.1324	4.9996	0.3073	12.4830	49.7000
• Maximum	4.1544	57.7875	2.1731	77.9880	95.0000
• Std.dev.	0.4875	9.9836	0.3588	14.2073	9.8494
• Coefficient of variation	0.1634	0.4803	0.4707	0.3580	0.1341
• Skewness	0.6553	0.9318	1.7300	0.0058	-0.5448
• Excess kurtosis	-0.5646	0.4597	3.5538	-0.5079	-0.1837

Apart from the first moment statistics, the results of other statistics are also evident from the table. Kurtosis measures the peakedness or flatness of the distribution of the series. The statistic for excess kurtosis shows that economic growth, urbanization and fiscal freedom are platykurtic (flat-topped relative to the normal), while government revenue, openness to trade are leptokurtic (peaked relative to the normal). Skewness is a measure of asymmetry of the distribution of the series around the mean. The statistic for skewness shows that all variables except fiscal freedom are positively skewed, implying that this distributions have long right tails.

Table 2 presents the ranking for each country with respect to the economic variables. This is interpreted from the top to the least country respectively. The result reveals that Angola has the highest mean government revenue of 40.010% of GDP and ranking 1st, while Nigeria has a mean of 9.643% of GDP and ranks 18th and the least ranked country was Sierra leone with a mean of 9.553% of GDP and ranks 19th. Also, Seychelles has the highest mean of openness to trade of 1.886% share of GDP and ranks 1st, Nigeria has a mean openness to trade of 0.570% share of GDP and ranks 13th, while Benin has a mean openness to trade of 0.451% of GDP and ranks 19th least among the countries selected. Also, Seychelles mean economic growth rate over this period is 4.085% per capita GDP and ranks 1st, Nigeria has a mean economic growth rate of 2.942% per capita GDP and ranks 10th and Ethiopia is least ranked, that is 19th, with a mean growth rate of 2.292% per capita GDP. It can be seen from the table that Tunisia has is ranked 1st with 65.499% urbanization rate in this region, Nigeria ranked 10th with a mean urbanization of 41.277% and Uganda grows with a mean urbanization rate of 13.767% and ranks 19th. Finally, Angola has a mean fiscal freedom of 84.757 and ranks 1st, Nigeria has a mean fiscal freedom of 83.960 and ranks 2nd while the least ranked is Togo with a mean fiscal freedom of 56.180.

Table 2 Descriptive Statistics of the Economic Variables. Mean, Standard deviation in bracket and the Rank of each Country in relation to the Variables.

Countries	GR	Rank	OT	Rank	EG	Rank	UR	Rank	FF	Rank
Nigeria	9.643 (3.039)	18th	0.570 (0.107)	13th	2.942 (0.068)	10th	41.277 (2.657)	10th	83.960 (0.721)	2nd
South Africa	29.522 (1.594)	4th	0.599 (0.068)	12th	3.738 (0.029)	2nd	60.875 (1.624)	2nd	69.460 (0.698)	12th
Egypt	25.242 (2.274)	7th	0.558 (0.098)	15th	3.143 (0.046)	9th	43.021 (0.044)	8th	80.270 (12.510)	6th
Uganda	12.761 (1.480)	15th	0.494 (0.103)	17th	2.549 (0.052)	16th	13.767 (0.885)	19th	80.590 (0.152)	5th
Ghana	18.178 (3.679)	8th	0.838 (0.154)	8th	2.751 (0.063)	11th	49.010 (2.060)	5th	80.910 (4.347)	4th
Kenya	17.212 (1.595)	10th	0.566 (0.040)	14th	2.743 (0.032)	12th	22.629 (1.150)	17th	79.290 (2.964)	7th
Tunisia	28.334 (2.211)	6th	0.985 (0.105)	4th	3.545 (0.041)	4th	65.499 (0.539)	1st	74.000 (3.603)	9th
Angola	40.010 (10.389)	1st	1.186 (0.125)	2nd	3.330 (0.109)	6th	42.473 (12.643)	9th	84.757 (5.960)	1st
Morocco	32.624 (2.478)	3rd	0.752 (0.097)	9th	3.333 (0.045)	5th	56.429 (1.509)	3rd	65.160 (2.571)	16th
Cote d'ivoire	15.738 (1.292)	13.5th	0.900 (0.042)	6.5th	2.994 (0.009)	7.5th	48.703 (2.220)	6.5th	60.620 (12.336)	17.5th
Burkina faso	15.738 (1.292)	13.5th	0.900 (0.042)	6.5th	2.994 (0.009)	7.5th	48.703 (2.220)	6.5th	60.620 (12.336)	17.5th
Mali	16.770 (0.782)	11th	0.646 (0.048)	11th	2.671 (0.023)	14th	34.032 (2.372)	15th	66.880 (4.576)	13th
Benin	17.636 (1.276)	9th	0.451 (0.050)	19th	2.737 (0.009)	13th	40.927 (1.134)	11th	65.460 (9.814)	14th
Ethiopia	10.470 (1.496)	17th	0.453 (0.038)	18th	2.292 (0.102)	19th	16.516 (0.982)	18th	74.320 (3.115)	9th

Madagascar	11.424 (1.262)	16th	0.735 (0.083)	10th	2.445 (0.017)	18th	30.408 (1.831)	16th	81.720 (4.961)	3rd
Namibia	28.577 (3.331)	5th	1.013 (0.153)	3rd	3.589 (0.043)	3rd	39.133 (3.015)	12th	66.780 (1.786)	15th
Seychelles	38.584 (4.922)	2nd	1.886 (0.217)	1st	4.085 (0.049)	1st	51.700 (0.767)	4th	73.325 (5.527)	11th
Sierra leone	9.553 (1.283)	19th	0.518 (0.170)	16th	2.540 (0.037)	17th	37.551 (0.851)	13th	76.660 (4.692)	8th
Togo	16.628 (1.240)	12th	0.949 (0.047)	5th	2.584 (0.007)	15th	36.362 (1.422)	14th	56.180 (6.642)	19th

Having described the characteristics of the data, we begin by checking the correlation between these variables (Table 3) and running a multicollinearity diagnostic check (Table 4) using the variance inflation factor and tolerance rate to determine if multicollinearity is present or not.

It is observed that government revenue shows a positive and significant relationship with the degree of openness to trade, economic growth, and urbanization which is put to about 61%, 79% and 55% respectively indicating that as government revenue increases, these economic variables also increases significantly. While it has a negative but not significant relationship with fiscal freedom, meaning as government revenue increases, fiscal freedom decreases but not at a significant rate and vice versa. The degree of openness to trade has a positive and significant relationship with economic growth and urbanization, indicating that as degree of openness is increased, economic growth and urbanization increases significantly, while it has a negative and significant relationship with fiscal freedom. Also, the results obtained indicates that economic growth has a positive and significant relationship with urbanization, implying that as economic growth increases, the urbanization rate increases significantly, but a negative and not significant relationship with fiscal freedom. Lastly, urbanization has a negative and significant relationship with fiscal freedom, revealing that as urbanization rate increases, fiscal freedom decrease significantly.

Table 3 Correlation coefficient matrix with p-values in bracket

	GR	*OT*	*EG*	*UR*	*FF*
GR	1.000				
OT	0.608*** (0.000)	1.000			
EG	0.788*** (0.000)	0.664*** (0.000)	1.000		
UR	0.546*** (0.000)	0.440*** (0.000)	0.724*** (0.000)	1.000	
FF	-0.078 (0.298)	-0.158*** (0.034)	-0.106 (0.159)	-0.236*** (0.001)	1.000

*** corresponds to statistically significant at 5%.

Table 4 Multico-llinearity diagnostic test

Factor/ Variable	*Multicollinearity Diagnostic Test*	
	Tolerance rate	*Variance Influence Factor (VIF)*
GR	0.612	1.633
OT	0.696	1.437
UR	0.653	1.531
FF	0.933	1.072

Multicollinearity is a serious case if tolerance rate < 0.4, and VIF > 10.

Table 4 above shows the testing of multicollinearity using Tolerance rate and VIF. There is serious case of multicollinearity whenever the tolerance rate is less than 0.4 and the VIF is greater than 10. Hence, since the result of the test shows that no tolerance rate is less than 0.4 and no VIF is greater than 10, we conclude that the model fitted does not suffer from the problem of multicollinearity.

5. CONCLUSION

This study has attempted to fit a parsimonious model that best predict economic growth of the sub-Saharan Africa using the Pooled OLS model which pools the countries together and considers them the same, thereby minimizing error that may arise between them. This study further attempts to ascertain the combined effect of the macroeconomic variables - Government revenue (GR), Urbanization (UR), Openness to trade (OT) and Fiscal freedom (FF) on Economic growth (EG). The study also fitted a Fixed Effect model to best explain the unobserved effect present in this countries that is, in terms of the individuality and heterogeneity of each of the country. We found out that Government revenue, Urbanization, Openness to international trade have a positive and significant effect on the economic growth of the region while that of Fiscal freedom was positive. Implying that Government revenue has a negative impact on the economic growth which contradicts the theory of having a positive impact on economic growth.

Some key recommendations made from the findings of this study were first, improving and strengthening the components of economic freedom (fiscal freedom) will certainly create a more pleasant investment climate favorable for businesses to flourish. Since a business environment consistent with economic freedom can foster economic growth in order to attract inflows of investors. Secondly, Openness to trade is another important predictor for driving growth but must be cautiously allowed in order not to discourage indigenous manufacturers. Thirdly, excessive and unnecessary spending of the generated revenue by the governments of these countries should be drastically reduced and continuity in government projects should be encouraged.

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